Mosquito Larvæ and Freshwater Fish.

By Dr. R. Hanitsch.

The following pages contain a Report which I prepared, at the request of Government, upon the possible usefulness of the small fish *Haplochilus panchax*, the 'Ikan mata lalat' of the Malays, in keeping down Mosquito larvæ and consequently Malaria, as the fish 'Millions' of Barbados is said to do.

The island of Barbados enjoys a remarkable immunity from fever, and two or three years ago, when the reason of this was put down to the presence in enormous numbers, on the island, of a certain fish which feeds on small crustaceans and insects, including mosquito larvæ, the Colonial Office decided to try the experiment of distributing that fish among the various tropical Colonies, to ascertain if it might be of any service in checking Malaria in other places as well. This fish, the 'Millions' (*Girardinus pœciloides*, de Filippi *), so called on account of the enormous numbers in which it occurs in Barbados, is only a small species, according to Günther, about $1\frac{1}{2}$ inches in length, and belongs to the family Cyprinodontidæ.

The Zoological Society of London, together with the Agricultural Department of Barbados, declared itself willing to help in the experiment and in the distribution of the Fish, though there was some scepticism as to whether the experiment would be a success.† However, as a closely allied fish, *Haplochilus panchax*, the 'Ikan mata lalat' of the Malays, occurs in the Malay region, it was thought that before introducing here the 'Millions' of Barbados, it should be ascertained whether the *Haplochilus panchax* might not be as effective in checking Mosquito larvæ, and I was accordingly asked to investigate the matter.

Raffles Museum and Library
Singapore.
15th May, 1912.

To the Hon'ble The Colonial Secretary, S.S.

Sir,

In accordance with your minute of 21-3-1912 (H. C. $\frac{204}{1912}$) I have the honour to submit herewith a Report on the distribution and habits of the fish *Haplochilus panchax*, H. B.

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* Günther (Brit. Mus Catal. Fishes, Vol. VI, p. 356) and D. S. Jordan and B. N. Evermann (The Fishes of North and Middle America, Vol. I, p. 689) refer to it under the name *Lebistes pœciloides*.

† See letter of Captain J. A. M. Vipan in Proceedings, Zoological Society, 1910, pp. 146-147.

As the object of the enquiry is to ascertain whether the fish might be of the same use as the fish "Millions" (*Girardinus pœciloides*) of Barbados in keeping down mosquito larvæ and consequently malaria, it would have served no purpose if I had restricted my enquiry to that one species of fish, and I have therefore attempted to collect species of all freshwater fish in the neighbourhood of the town of Singapore, and have made experiments as to whether they feed on mosquito larvæ or not.

Obviously only the smallest species of freshwater fish were found in the small ditches, and of these *Haplochilus panchax*, the "Ikan mata lalat" of the Malays, seemed to be the most common. Like the "Millions" of Barbados, it belongs to the family Cyprinodontidæ, which, according to Günther, includes the smallest fish known. It grows to only about 2″ in length, but notwithstanding its small size it is probably the best known of the local freshwater fish, not so much on account of its numbers, as from the very conspicuous bright silvery spot on the top of its head. It is of slow moving habits, and generally keeps close to the surface of the water. We found it in the following places:—junction of River Valley Road and Leonie Hill Road; Tanglin Road; Botanic Gardens; off Orange Grove Road; Kim Kiat Road; Syed Ali Road; Gaylang Road; Teluk Blangah Road, but it could be found in almost any ditch capable of holding fish. It eats mosquito larvæ, but not greedily.

Another small species, also common, though less so than the previous one, is the *Hemirhamphus fluviatilis*, Bleeker (Ikan jolong jolong). It is an ally of the Gar-Pike and the Flying fish, and it is easily recognised by its lower jaw being drawn out into a long beak. It grows to about $2\frac{1}{2}$″ in length, and was found in the following places:—junction of River Valley Road and Leonie Hill Road; Orange Grove Road; Tanglin Road; Jervois Road; Kim Kiat Road; Teluk Blangah Road. It is a delicate fish, not always surviving the journey to the Museum. It is herbivorous, living on Algae and Waterweeds, and does not eat mosquito larvæ.*

A great favourite amongst sporting natives is the Fighting Fish (*Betta pugnax*, Cantor), or "Ikan pelaga". It grows to about $3\frac{1}{2}$″. It has a large ventral fin, drawn out to a point posteriorily, and its colour is a dull purple, which, however, changes into dazzling metallic colours when the fish is excited. It is very active, and ate mosquito larvæ greedily within a few seconds of their being given to it. We found it in Somerset Road; Jervois Road; Moulmein Road; and in large numbers, especially, in the pond at the junction of Syed Ali Road and Thompson Road, which is being filled up at present.

A larger fish than any of these above is the "Ikan sepat" (*Osphromenus trichopterus*, Pall.), belonging to the same family as

*I have since repeated the experiment with the same result, and this fish seems to be the only one of those I examined which does not eat mosquito larvæ.

the Fighting Fish, viz. the Labyrinthici. It is edible, but is much less valued than Gurami (*Osphromenus olfax*) which for the table is regarded as the best of the local freshwater fishes. The Ikan sepat grows to about 4", and is distinghished by its beautiful irridescent colours and its ventral fin being transformed into a long thread-like ray, often reaching beyond the tail. It has two round black spots on either side, which are very marked in the young. We caught it in Orchard Road (in the ditch in front of the Police Station), in Jervois Road, Somerset Road, Syed Ali Road, and noticed it also in the swamps near Teluk Blangah Road. The young ate mosquito larvæ, though not ravenously, whilst full grown specimens seemed to despise them.

To the same family belongs the "Ikan betok" or Climbing Perch (*Anabas scandens*, Dald.) The largest specimens we found measured about 4½", though, according to Cantor, it grows up to 7". This fish can live a long time out of water, and it is well ascertained that it can travel on land, pushing itself along by its fins. We caught it off Gaylang Road, and noticed it in the swamps at Teluk Blangah. The young ones ate mosquito larvæ greedily. No experiments were made with full grown specimens.

The 'Ikan aruan' (*Ophiocephalus striatus*, Bl.), belonging to the family of Ophiocephalidæ, is also able to live out of water and to travel over damp grass. It is much eaten, and grows, according to Duncker, to about 2½ feet in length. The young ones, of which we caught some at Syed Ali Road, are of a golden orange colour, and ate mosquito larvæ greedily. We saw the same fish at Teluk Blangah.

The Catfish, or "Ikan keli" (*Clarias magur*, H. B.), occurs in many places in Singapore Island, such as the Botanic Gardens, Syed Ali Road, Teluk Blangah Road, but no experiments were made with it.*

The above enumerated fishes seem to be the more common ones in the neighbourhood of Singapore town. Whilst collecting them we were constantly on the look out for mosquito larvæ (Malay name "jentek-jentek"), and it must be stated that, perhaps with one exception, no mosquito larvæ were found in any great numbers in places in which there were fish or which were easily accessible to fish.

For instance I had expected to find many mosquito larvæ in the swampy district between Killiney Road, Devonshire Road, and

* I may add a few words, as I have since been able to get additional material, from Lavender Street. The Catfish, thus called from the eight long barbules which arise from around its mouth and have some resemblance to a cat's whiskers, lives in muddy water and is a very active and shy fish. It grows, according to Cantor, to at least 1½ feet in length, but experiments were naturally made only with small specimens, one to two inches in length, such as would be likely to feed on mosquito larvæ. The first experiments were quite negative in result, and only after the fish had been kept on short rations for a couple of days, did it begin to eat mosquito larvæ. Its usual diet seems to be decaying animal and vegetable matter.

Somerset Road, but discovered them (those of *Culex*) only in a single pool, and that contained no fish. I then examined the compound of a European house in Killiney Road, which is unoccupied at present, and found the place littered with old tins full of the larvæ of the Tiger Mosquito (*Stegomyia fasciata*).

An examination of certain pools off Gaylang Road showed striking results, from which, however, it might be rash to generalize. The pools were at the edge of the mangrove zone, they were numerous, and had been formed to a great extent as depressions between the mounds of the Cray-fish *Thalassina anomala*, which is so common in such localities. One of the pools was thick and black with mosquito larvæ (*Culex*), but contained no fish; another pool, only about a yard off, was free from larvæ, but contained fish (Ikan mata lalat).

We also examined the most malarial region in Singapore, the swamps of Teluk Blangah, and found mosquito larvæ in the following situations: in empty tins lying about; in freshly formed pools at the top of the reclamation; in a small pool, at a level with the main pool, which contained only a single specimen of a fish (Ikan mata lalat); and, finally, we found numbers of the larvæ of *Anopheles* in the dense masses of waterweed in the largest pool there, the weed being so thick that probably no fish could penetrate it. Besides, the weed was so full of other minute animal life, that, even if a fish had penetrated there, he could scarcely have been expected to devote himself entirely to the mosquito larvæ. The open and clean stretches of water in the pool contained several species of fish (Ikan mata lalat, Ikan jolong-jolong, Ikan betok, Ikan sepat, Ikan aruan and Ikan keli), but we did not notice any mosquito larvæ there.

The pond at the junction of Syed Ali Road and Thomson Road, which is being filled up at present, certainly contained mosquito larvæ (*Culex*) in places which seemed quite accessible to the numerous fish in it, but the general microscopic life there was so abundant that there was no need for any fish to restrict its diet to mosquito larvæ especially.

Whether the fish "Millions", if imported into such a locality, would show a marked predilection for mosquito larvæ, is doubtful. It is also uncertain whether it would be able to hold its own against the several species of fish indigenous to Singapore Island. In Barbados it is only the freshwater fish known (see Captain Vipan's letter in Proc. Zoological Society, February 1910, pp. 146-147), and it may not be equal to the competition with any other fish. However, as the Agricultural Department of Barbados has arranged to send from time to time consignments of "Millions" to the Zoological Gardens, London, from there to be distributed through the Colonial Office to various tropical Colonies, the experiment of bringing some to Singapore should be easy and inexpensive, best perhaps on a troopship in charge of the ship's surgeon. But it must be remembered that to introduce an animal into another part of the

world always brings the risk of the accidental introduction of some other and undesirable organism. In the meantime it seems advisable to fill up all large pools in the neighbourhood of the town, or, if this is not feasible, to clean them of all surplus vegetation, and to introduce into them small species of fish such as are known to feed on mosquito larvae, like the "Ikan mata lalat" and especially the "Ikan pelaga".

However, there must be in a town like Singapore many localities in which *Anopheles* and other mosquitos breed, and which are quite inaccessible to fish, and by far the greater area of the town would probably not be touched at all by preventive measures, such as the introduction of fish. If, as I know from my own experience, *Anopheles*, besides *Culex* and *Stegomyia*, may practically any day be found in a comparatively healthy part such as Fort Canning Road, then an attempt to exterminate malaria by means of fish in the crowded central districts of the town would be utterly hopeless. But the experiment might be of use in the outskirts of the town.

I have the honour to be,

Sir,

Your obedient servant

R. HANITSCH,
Director.